Pixel Barrel Module Alignment Using Overlaps

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Introduction

- **Develop alternative strategy that provides cross check and ultimately improve the pixel alignment.**

- **Constraining the neighboring modules together using overlaps.**

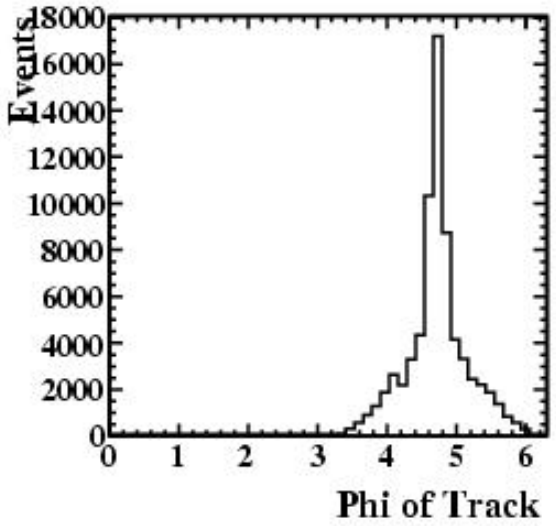
- **Overlap is defined for a track passing through two neighboring modules in the same layer and in the same eta ring.**

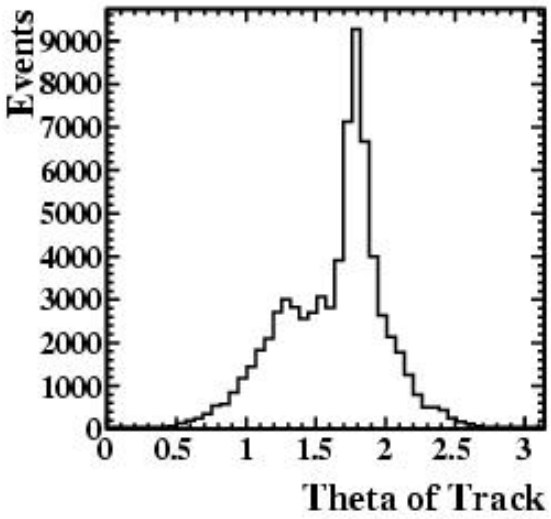
- **Advantage of this reduces a large number of modules into a small number of regions that requires fewer degrees of freedom to solve in the global χ^2.**

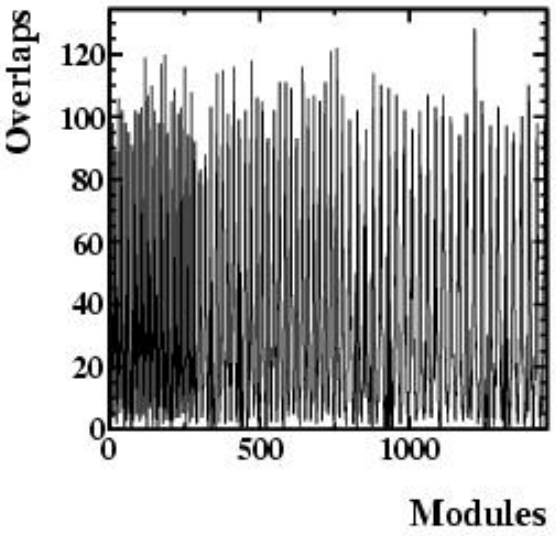
Datasets and Event Selections

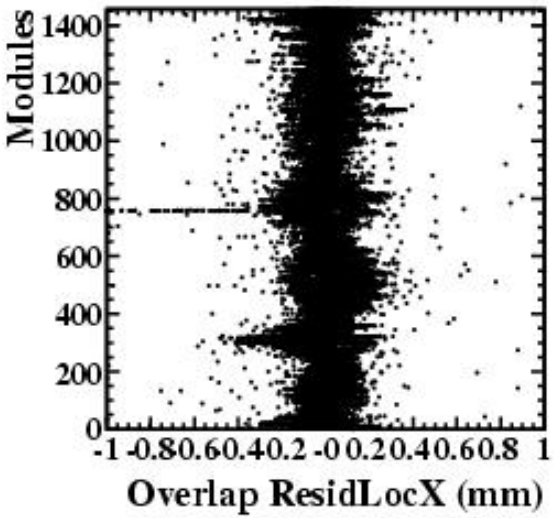
- **Using most of cosmic bfield off data from Max, about 180K.**
- **Reprocessed with default cosmic tracking with latest cosmic 03 alignment file.**
- **Selections:**
  - **Cluster size $<$ 5 and no duplicated events.**
  - **At least three pixel hits and two far apart hits on layer 2.**
- **Recomputing the cluster positions with GLX2.7 alignment file (Vicente).**

Cosmic Tracks and Overlaps



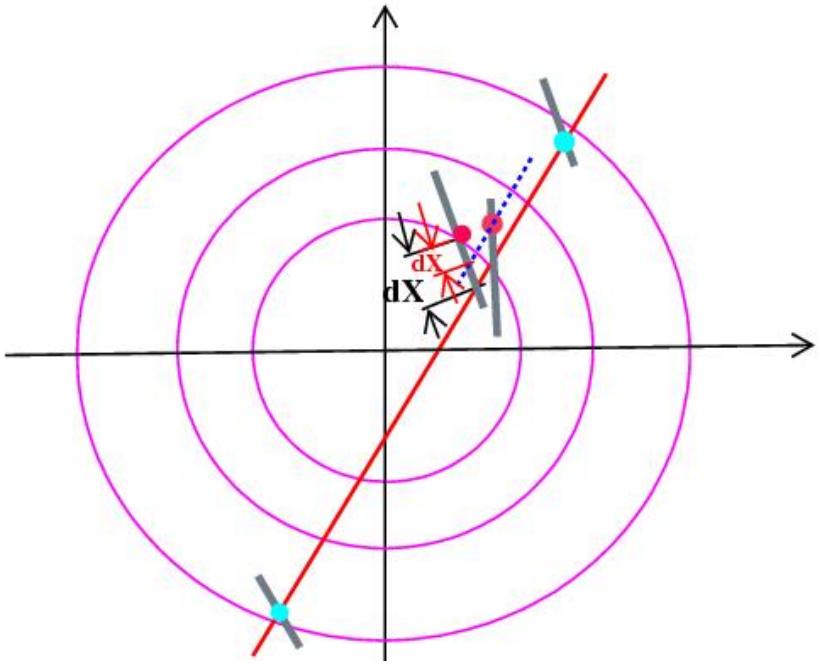




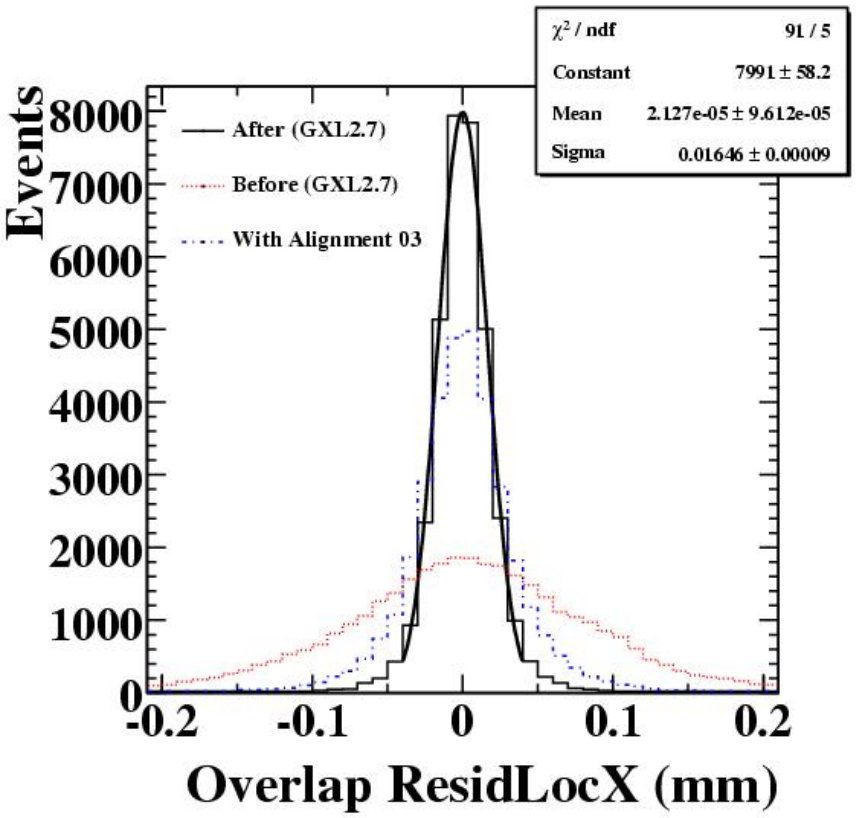


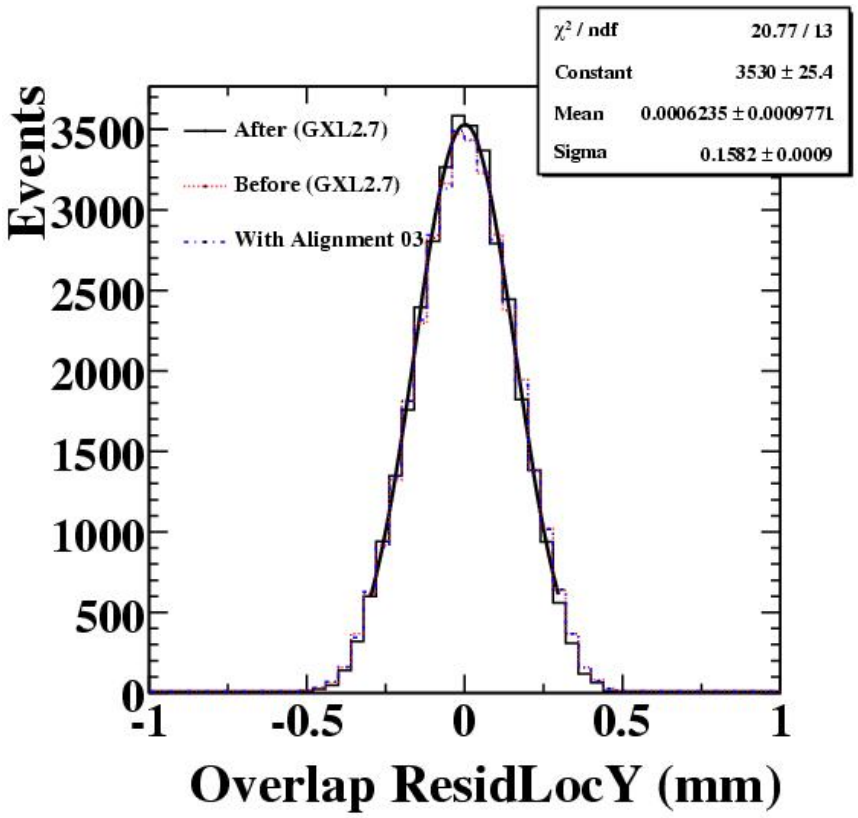
Alignment Strategies

- **Step 1: Constraining the relative misalignment between neighboring modules using overlap residuals.**
- **Step 2: Starting two far hits on layer 2 and propagating into layer 0 and 1**
- $\chi^2 = \sum (x_{exp} - x_{hit})^2/\sigma_x^2 + (y_{exp} - y_{hit})^2/\sigma_y^2$
- **There are 86 regions with 5 degrees of freedom each that gives a 430 x 430 matrix to solve in the global χ^2 fit.**



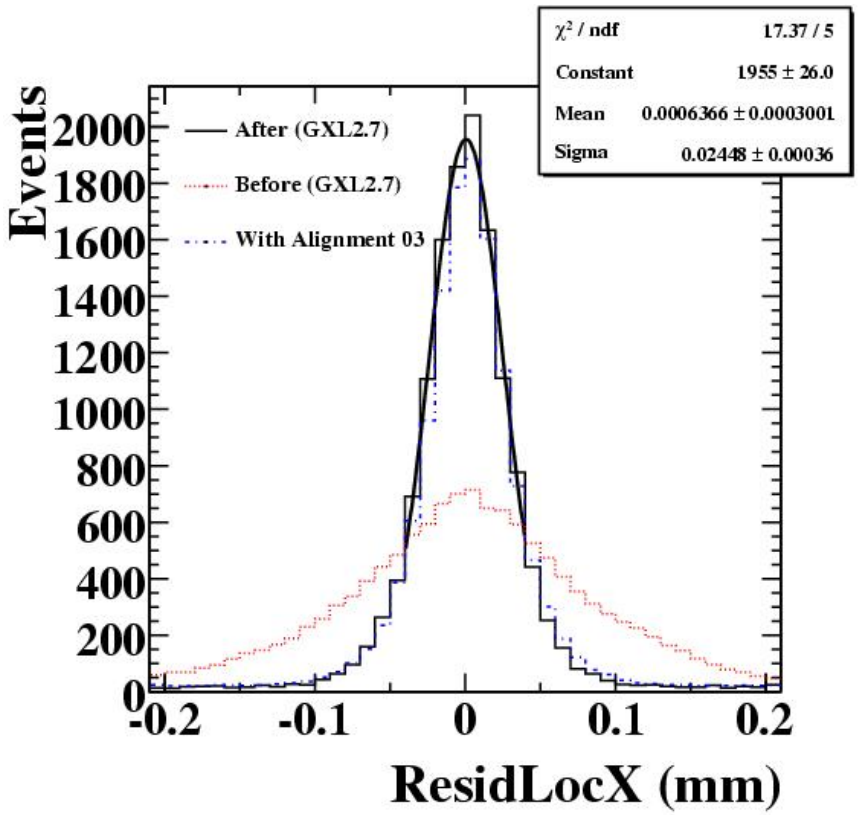
Overlap Residuals after Correction (GXL2.7)

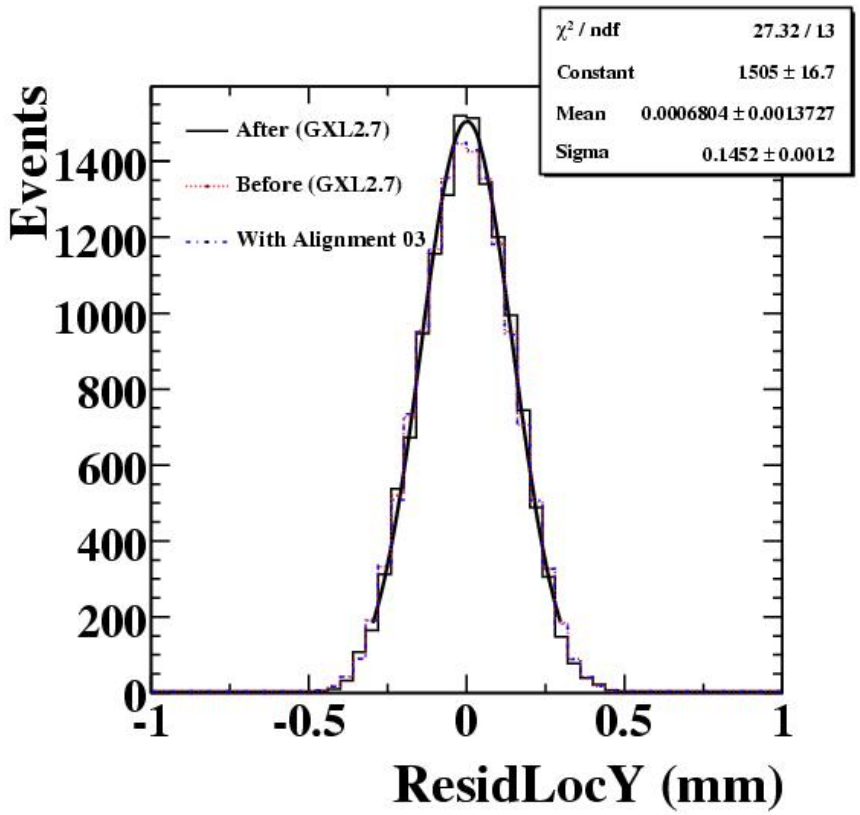




	GXL2.7	Alignment 03	After Correction
Loc σ_X (μm)	77	25.6	16.5
Loc σ_Y (μm)	162	162	158

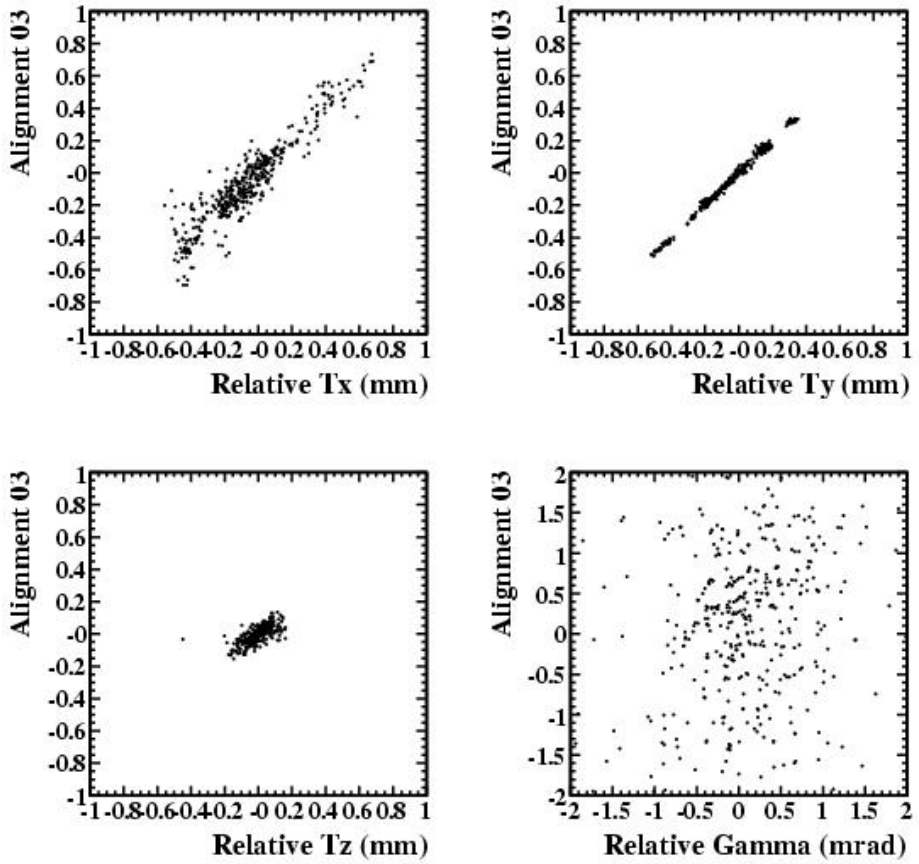
Residuals of layer 0 and 1 after Correction (GXL2.7)





	GXL2.7	Alignment 03	After Correction
Loc σ_X (μm)	73	25.4	24.5
Loc σ_Y (μm)	151	151	145

Comparison of Relative Alignment Constants Between Overlaps



- **Derived relative alignment from overlap residuals and compared to alignment 03.**
- **Consistent with translations, but not much in γ.**

Conclusion

- **The alternative alignment strategies using overlaps seem promising and give comparable results.**
- **The overlap residual seem much better, but not much in residuals of layer 0 and 1 (why ?)**
- **Still statistics limited.**
- **Interesting to see how the final constants compares to the other methods.**